

A new Genus and Two New Species in the Family Mithrodiidae (Echinodermata : Asteroidea) with Comments on the Status of the Species of *Mithrodia* Gray 1840

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ABSTRACT

A new genus and two new species of mithrodiid asteroids from the Pacific and Indian Oceans are described. *Mithrodia gigas* Mortensen, from South Africa, is referred to the new genus. The status of the species of *Mithrodia* is discussed. *Mithrodia fisheri* Holly and *Mithrodia clavigera* (Lamarck) are retained as valid species but *Mithrodia victoriae* Bell and *Mithrodia bradleyi* Verrill are provisionally referred to the synonymy of *M. clavigera*.

INTRODUCTION

During a visit to the Aquarium of Nouméa, New Caledonia, in 1969, the senior author was brought a giant asteroid, taken locally by the Aquarium's scuba divers. It clearly represented an undescribed form of the family Mithrodiidae. For several years this specimen was thought to be unique. Subsequently a specimen was sent from Guam by Dr. L. G. Eldredge in 1971 and a juvenile from the Ogasawara Islands, taken in 1974, was forwarded to us by Dr. M. Yamaguchi. Finally two further specimens were taken in 1975 by M. Labout and Mr. A. Birtles, near the original locality, in the lagoon off Nouméa. Photographic evidence also exists of an undoubted specimen of this species from the Philippine Islands, recorded on the cover of a Japanese periodical, "Marine Diving" 1972, No. 15 (cover picture).

Two specimens from the Seychelles Islands, Indian Ocean, forwarded to us by Miss A. M. Clark of the British Museum (Natural History), proved to be closely allied to but specifically distinct from the Pacific specimens.

Research of the literature indicated that both of these forms are not only closely related to *Mithrodia gigas* Mortensen from South Africa, but also to the "peculiar specimens of *Mithrodia*" described and illustrated by Fisher (1906). It seemed to both of us, however, that their features were sufficiently distinctive

to separate them generically from other species included in the genus *Mithrodia* Gray by Engel, Dilwyn John and Cherbonnier in their 1948 revision of that genus. We also concluded that some of these authors' findings were incorrect and we therefore felt it appropriate that, while describing and justifying the new taxa, we should include our comments on the status of species within the genus *Mithrodia*.

DESCRIPTIONS

Order: Spinulosida.

Family: Mithrodiidae.

Genus *Mithrodia* Gray, 1840 p. 288.

DIAGNOSIS:

Slender-armed forms, usually 5-rayed (4- to 6-rayed), with R (centre of disc to arm tip) up to about 300 mm, r (centre to edge of disc) up to about 20 mm, so that R:r lies between 7.5 : 1 and 15 : 1 (usually about 10-12 : 1). Arms tapering to a fairly acute tip. Skeleton open or compact, reticulate, with plates and trabeculae bearing tubercles. The whole (body and spines) covered by a thick skin beset with scales or thorn-like granules.

Large, stout spines occur actinally and abactinally, forming up to 9 longitudinal rows (including the rows of subambulacral spines). Tubercles or spines absent from the papular areas. Marginal plates inconspicuous but their position indicated by two of the rows of stout spines. Infero- and supero-marginal rows separated, connected by trabeculae. Actinal intermediate areas narrow, with only one row of plates. Abactinal spines and spines of the first actinal intermediate row usually longer than the inner, subambulacral spines and first actinal spines occurring irregularly, one adjacent to every 1 to 7 of the subambulacral spines. Furrow spines finger like, 10 to 12 in webbed fans. Pedicellariae multi-valved, typical of the family, present actinally and abactinally.

TYPE SPECIES:

Asterias clavigera Lamarck, 1816
 = *Mithrodia spinulosa* Gray, 1840. Type species by monotypy: a synonym of *M. clavigera* fide Perrier, 1875; de Loriol, 1885 and subsequent authors.

OTHER SPECIES INCLUDED:

Mithrodia fisheri Holly, 1932; (*M. bradleyi* Verrill, 1867; *M. victoriae*, Bell, 1882 are provisionally referred to synonymy of *M. clavigera*)

Genus *Thromidia* gen. nov.

DIAGNOSIS:

Large, obese, 5-rayed forms with R up to 350 mm, r up to 85 mm. R:r as 4 : 1 up to 7 : 1. Arms with more or less parallel sides, tapering only distally

to a blunt, rounded tip. Skeleton is open or compact, reticulate. Skeletal plates bear small tubercles, the whole being covered by a thick skin with scale- or thorn-like granules. The larger, stout spines are restricted to a subambulacral plus one (rarely two) actinal rows. Tubercles occur in the papular areas. Marginal plates inconspicuous and without spines. Actinal intermediate areas wide, with several rows of plates. Spines of the first actinal intermediate row usually shorter than the inner, subambulacral spines and forming a regularly arranged line, one to each 2 (proximally) — 4 (distally) subambulacral spines. Furrow spines number up to 12, in webbed fans. Multi-valved pedicellariae, typical of the family, present only actinally and usually restricted to areas adjacent to and between the spines of the first actinal and subambulacral rows.

The only exception to the above diagnosed arrangement of spines is seen in a juvenile specimen (R = 58 mm) bearing an even distribution of small spines over the whole body (see p. 204, figs. 5-6 and p. 205).

ETYMOLOGY: Anagram of *Mithrodia*; gender, feminine.

TYPE SPECIES: *T. catalai* sp. nov.

OTHER SPECIES INCLUDED: *T. seychellesensis* sp. nov., *Mithrodia gigas*, Mortensen, 1935.

REMARKS:

This genus is separated from *Mithrodia* because of its much greater bulk, the shape of its arms, the restriction of the stout spines to the subambulacral and first (rarely the second) actinal rows, the regularity of the actinal row of spines, the wide actinal intermediate area and the presence of tubercles in the papular areas.

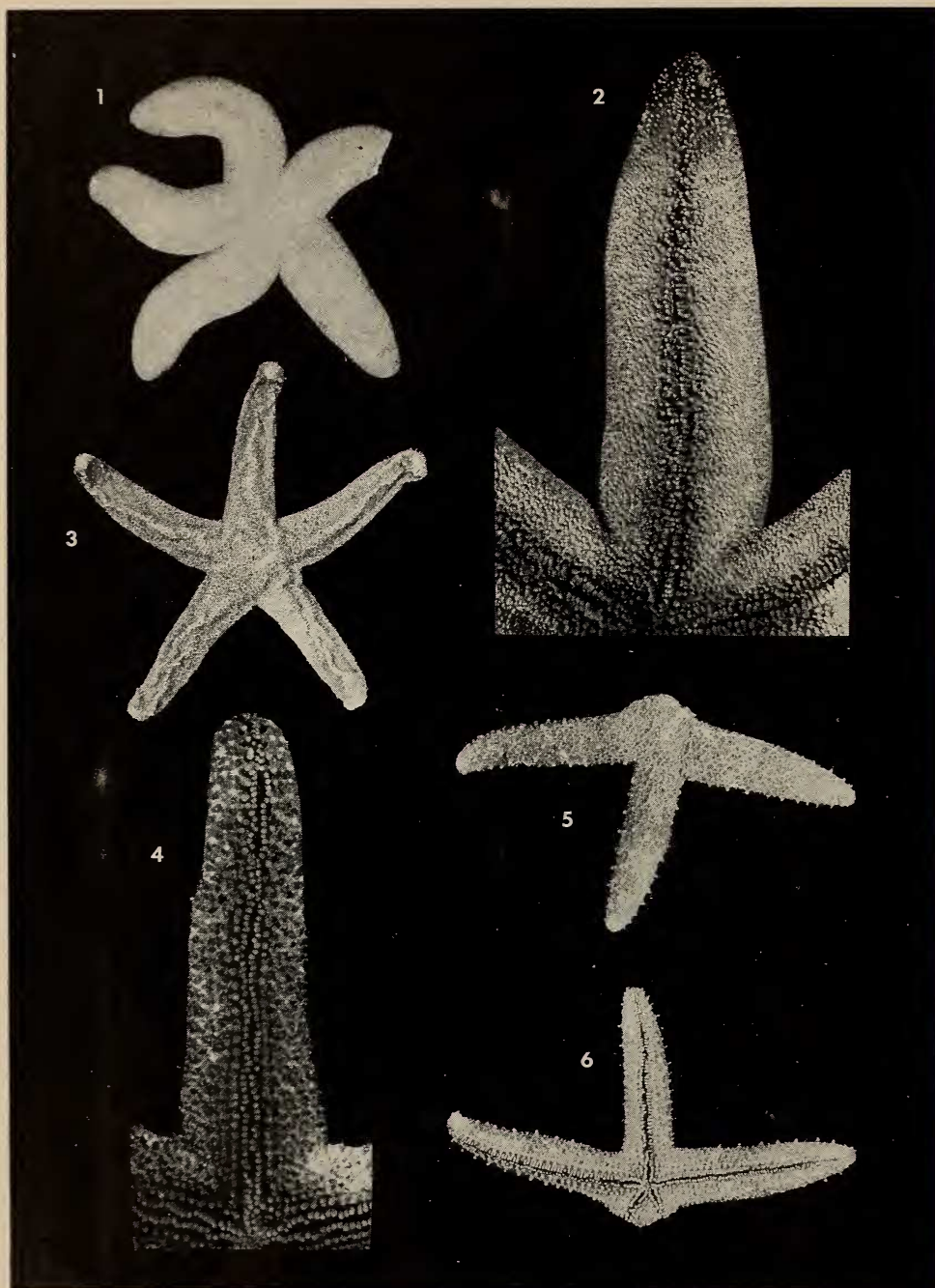
***Thromidia catalai* sp. nov.**

Figs. 1-6 and 9

Mithrodia sp., "peculiar specimen" Fisher 1906, p. 1069, Pl. XXXVII, figs. 2-3.
Mithrodia fisheri, Engel, Dilwyn John and Cherbonnier, 1948, p. 27 part.
 (non *Mithrodia fisheri* Holly, 1932).

MATERIAL EXAMINED:

Holotype, R = 352 mm (in life), 283 mm after preservation in alcohol (Australian Museum No. J. 7792), near base of Tabu Reef, off Îlot Amedée, New Caledonia, circa 10 m depth, on sandy bottom with boulders, 14.IX.1969, collected by M. B. Conseil and M. G. Bargibant for the Aquarium of Nouméa. Two paratypes: (Australian Museum No. J. 9926 R = 238 mm) and British Museum (Natural History) No. 1976.10.14.1, R = 225-250 mm after preservation and drying), both taken in the same locality as the holotype, on 11.VII.1975, collected by M. M.P. Labout and Mr. A. Birtles in a depth of c. 10 m; one paratype, (R = 245 mm preserved dry) from the vicinity of Guam Island, taken by scuba divers



Figs. 1-6. *Thromidia catalai* n. sp. 1, holotype, A.M. No. J7792, abactinal view, R = 283 mm. 2, paratype, B.P.B.M. No. W2507, actinal view of one arm, R = 245 mm. 3-4, juvenile, A.M. No. J10134, whole abactinal view (3); actinal view of one arm (4), R = 125 mm. 5-6, juvenile, U.S.N.M. No. 32271, abactinal (5) and actinal (6) views, R = 58 mm.

(no other data supplied), deposited at the Bernice P. Bishop Museum, Hawaii (W2507); one specimen (juvenile), $R = 125$ mm, preserved dry (Australian Museum No. J.10134) from Miyano-hama, Chichi-jima, Ogasawara Islands, 10 m depth, collected by Mr. T. Matuura, 24.III.1974; one specimen (juvenile) $R = 58$ mm (United States National Museum No. 32271) "Albatross" Station 4158, off the Bird Islands, Hawaii, 38-45 m, on coral and coralline bottom; one specimen (size not recorded; colour print only), Hansa Bay, 200 km north of Madang, Papua New Guinea, print sent by Dr. M. Jangoux, December, 1976.

DESCRIPTION:

A large obese species. In life adults range from $R = 355 - 384$ mm, $r = 82 - 90$ mm, $R/r = 4 - 4.6$; after preservation $R = 220 - 296$ mm, $r = 50 - 66$ mm and $R/r = 4 - 5.2$. The arms are slightly constricted at their origin from the disc, which is relatively small. The five arms are cylindroid with a taper which becomes marked only from approximately $2/3 R$. The madreporite is single, small and situated halfway between the centre of the disc and the interradiar margin (Fig. 1).

The skeleton of plates and radiating trabeculae form an open meshwork enclosing large papular areas (up to 10-11 mm in adults) in which finer, minute ossicles are present. Tubercles (about 1 mm wide by 1.5 mm high) are extremely numerous and crowded over the whole surface, occurring on the skeletal elements. Smaller tubercles occur in the papular areas. On the distal $1/7$ of the arm only the larger tubercles are present, becoming more widely spaced. There are no stout spines abactinally (Fig. 9).

The whole surface, including all the tubercles and actinal spines (even including a few of the furrow spines) is covered by a thick skin in which are scale- or thorn-like granules. These granules become enlarged and pointed towards the apical regions of the spines and tubercles. Marginal plates are inconspicuous and do not bear spines.

Actinal intermediate areas are broad, with 5-6 rows of plates between the adambulacral and ventral lateral (inferomarginal) margin (Fig. 2). Adambulacral plates each bear a webbed fan of 6-7 (sometimes 5-8) finger-like furrow spines, backed by a single, stout, scale-covered subambulacral spine, up to 8 mm high and 2 mm in breadth. The inner side of the subambulacral spine is often rubbed bare. A regular row of spines which are slightly shorter than the subambulacrals (6 mm high and 3 mm in breadth) are found on the first actinal row of plates. Each actinal spine occurs adjacent to every second subambulacral spine. A second row of spines, intermediate in size between those of the first actinal row and the tubercles covering the rest of the actinal surface, is evident particularly on the distal part of the arms (Fig. 2).

Pedicellariae are multi-valved, occurring only actinally between the first actinal and subambulacral rows of spines. Tube feet are large, with a double ampulla and large terminal disc.

A dried juvenile $R = 125$ mm and $r = 30$ mm, $R/r = 4.5$ from Ogasawara Islands, which judging from its photograph in life has become very shrunken, has tubercles which are restricted to the plates and do not occur on the trabeculae (Fig. 3). Usually only one or two tubercles occur in its papular areas. The spines of the second row of the actinal intermediate plates are more prominent, particularly distally, than in the adult specimens. There are only three rows of actinal intermediate plates (Fig. 4).

The larger of the two "peculiar specimens" recorded from Hawaii by Fisher (1906) is only about half the size of the holotype but his description and figures of it (plate XXXVII, figs. 2 and 3) do not indicate any major differences from the one we examined from the Ogasawara Islands. We have, unfortunately, been unable to locate the whereabouts of Fisher's larger specimen. The smallest specimen we examined (USNM No. 32271), labelled "*M. bradleyi* Verrill", coming also from the vicinity of Bird Islands, Hawaii, but from "Albatross" Station 4158, has proved something of an enigma (Figs 5-6). We believe it to be the smaller of the two "peculiar specimens" of *Mithrodia* recorded by Fisher (1906, p. 1096). Its Station number and locality data agree with Fisher's record but there is a discrepancy in the measurement he gives for R ($= 38$ mm according to Fisher). In all other respects it agrees with his short description. We found $R = 58$ mm, $r = 12$ mm, $R/r = 4.8$. Unfortunately Fisher did not figure this specimen so we cannot be absolutely certain that it is the specimen to which he refers. However, a simple typographical error (mistaking a 5 for a 3) would account for the difference in the measurements. There is no doubt, however, that this is a juvenile *Thromidia*. It exhibits characters which are not visible in the larger juvenile from Ogasawara Islands. This at first led us to believe it might represent a fourth species of *Thromidia* since it has small spines scattered abactinally. These are only slightly smaller than the subambulacral spines but are similar to those of the first actinal row. It is not unknown, however, for juvenile forms in this family to have abactinal spines which later disappear with growth (Engel et al. 1948, pp. 7-10). The position of the marginal plates is determinable by the spines carried on them. This is a feature not shown by the adults. The papular areas vary in diameter between 2-2.5 mm. In our present state of knowledge we agree with Fisher, that this is a still earlier stage of his larger "peculiar specimen". However, we conclude further that it should also be regarded as a juvenile of the giant Pacific species *T. catalai*. The colour note given by Fisher adds convincingly to the argument for considering this specimen a juvenile of *T. catalai*.

COLOUR:

In life (adults), uniformly pink abactinally, deeper pink actinally, with arm tips cinnamon-brown; actinal and subambulacral spines rose-red with their flattened tips cream; furrow spines cream; tube feet whitish with the terminal disc muddy-brown. A colour print of the live juvenile from Ogasawara Islands shows it to be rose red, with arm tips a darker red. Fisher recorded the life colour of the larger of the "peculiar specimens" as "dull, light cinnamon-pink and

NEW SPECIES OF MITHRODIIDAE

maroon at end of the arms, the cinnamon mottled in places with buff. Actinal surface is light pinkish buff or vinaceous, darkest on tubercles. Ambulacral feet raw sienna”.

HABITS:

In the field the starfish have been observed lying in the open, on the bottom, in depths of 10 m or more. In one instance one was observed with its stomach everted over a grey, encrusting sponge, growing on a coral boulder (A. Birtles, personal communication). The holotype and the larger of the two specimens captured by Labout and Birtles were kept alive over periods of up to 10 months in the Aquarium of Nouméa and Mme. Catala reported that no solid food (flesh of fish, crustacea and molluscs) such as was fed to the fish and other inhabitants of their tank was taken by *Thromidia*, but it survived by feeding on encrusting growths on the boulders and side walls of the tank. The animals are more active by night and are capable of moving on their tube feet at speeds of up to 25 mm per second. The specimen now selected as the holotype A.M. J7792 lived unmolested for several months in the largest tank at the Aquarium which it shared with a number of species of fish, molluscs and stingrays. However, a newly introduced fish (a balliste) immediately attacked the starfish, tearing a hole in one arm. The attack was not repeated but the starfish responded to the injury by emitting a stream of whitish eggs upon which the fish fed. At this stage the *Thromidia* was removed from the tank for preservation.

When *Thromidia* lay on the bottom it was frequently observed to become covered abactinally by pebbles and shellgrit which rained down on it as a result of the feeding activities of certain species of fish. It seemed incapable of cleaning itself while flat on the bottom but the rubbish fell off when the starfish climbed vertical surfaces. The starfish could move on its tube feet with equal facility over a loose or solid substratum.

ETYMOLOGY:

The species is named in honour of Mme. Stucki and Dr. René Catala of the Aquarium of Nouméa who sponsored the collection of the Nouméa specimens and also kept *Thromidia* alive in their Aquarium making notes and observations on its behaviour.

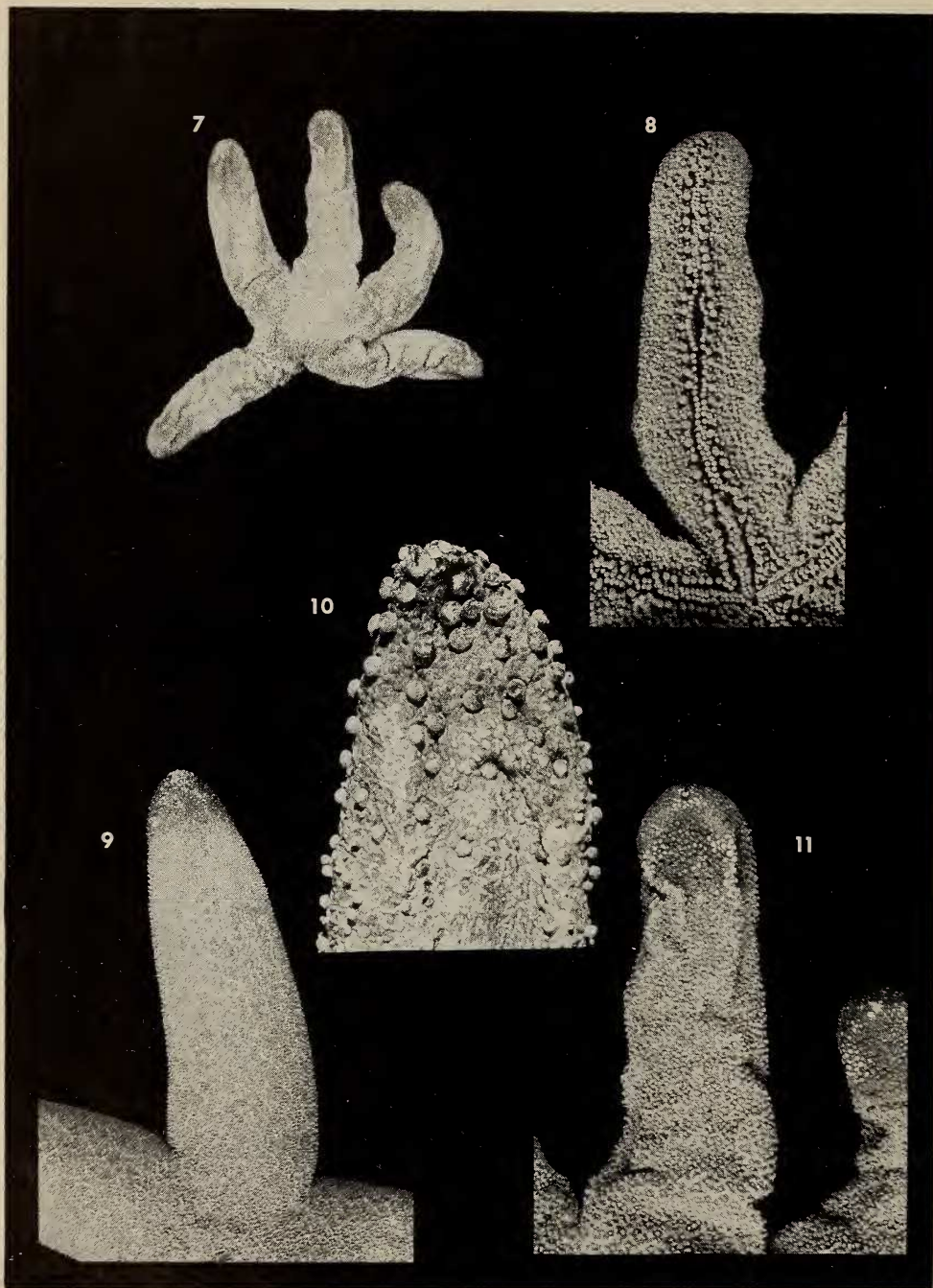
***Thromidia seychellesensis* sp. nov.**

Figs. 7-8 and 11

Mithrodia fisheri, Jangoux, 1974, p. 791 (non *M. fisheri* Holly, 1932).

MATERIAL EXAMINED:

Holotype R = 123 — 124 mm (British Museum [Natural History] No. 1974.9.25.18); Recife d'Anse a la Mouche, Mahé Isle, Seychelles, Indian Ocean, collected by Dr. M. Jangoux, 1972; Paratype R = 135 mm (B.M. [N.H.] No.



1976.10.14.2) Seychelles, Cousin Id, 12 m, October, 1972, collected by R. A. Birtles.

DESCRIPTION:

A species with five cylindroid arms which have parallel sides along the greater part of the length, tapering only slightly to a rounded, blunt tip. $R = 123 - 124$ mm, $r = 22 - 23$ mm, $R/r = 5.5$ (Holotype); $R = 135$ mm, $r = 27 - 28$ mm, $R/r = 4.9$ (Paratype). The madreporite is rather insignificant and positioned half way between the centre of the disc and the interradial margin (Fig. 7).

The skeletal plates and radiating trabeculae form a compact meshwork enclosing small papular areas (up to 3.5 mm diameter). Tubercles (about 0.6 mm wide by 0.75 mm high) are numerous and crowded over the actinal and abactinal surfaces, occurring on the skeletal elements. A smaller tubercle occurs in each of the papular areas (Fig. 11). On the distal $1/5 - 1/4$ of the arms the plates are rounded convex and are closely packed together, giving the tip of the arms the appearance similar to that of a cobbled pavement (Fig. 11). The distal papular areas are so small that they contain only one or two papulae. Occasionally the smaller tubercles persist on these papular areas. Trabeculae connecting the larger plates are very reduced. There are no stout spines abactinally.

The whole surface, as in *T. catalai*, is covered with a thick skin beset with scale- or thorn-like granules. These granules become slightly enlarged towards the apical region of the spines and tubercles but the distal arm plates are characterised by the even size of the granules covering them (Fig. 11). The marginal plates are inconspicuous.

Actinal-intermediate areas are broad, with 3-4 rows of plates between the adambulacral plates and the ventro-lateral (inferomarginal) margin (Fig. 8). Adambulacral plates each bear a webbed fan of 6-8 furrow spines backed by a single, stout subambulacral spine up to 4.5 mm high and 1.5 mm in breadth. The inner side of the subambulacral spine is often rubbed bare. A regular row of spines, shorter than the subambulacrals (3.5 — 4.5 mm by 1.5 — 2.0 mm) is found on the first actinal row of plates. The actinal spines are spaced, proximally, adjacent to every second subambulacral spine, but more distally (beyond $1/2R$), particularly on the holotype, adjacent to every 3rd or 4th subambulacral spine. A second row of spines, intermediate in size between those on the first actinal

Figs. 7-8. *Thromidia seychellesensis* n. sp., holotype, B.M. (N.H.) No. 1974.9.25.18, whole abactinal view (7); actinal view of one arm (8), $R = 123-124$ mm

Fig. 9. *T. catalai* n. sp., paratype, B.P.B.M. No. W2507, abactinal view of arm, $R = 245$ mm.

Fig. 10. *T. gigas* (Mortensen), holotype, S.A.M. No. A 22561, abactinal view of arm, $R = 330-347$ mm.

Fig. 11. *T. seychellesensis* n. sp., holotype, B.M. (N.H.) No. 1974.9.25.18, abactinal view of arm-tip, $R = 123-124$ mm

row and the tubercles covering the rest of the actinal surface, is evident particularly on the distal parts of the arms (Fig. 8).

Pedicellariae are typical of the family and distributed as in *T. catalai*. It is possible that the specimens of *seychellesensis* described above represent a young stage of the species.

COLOUR:

The dried holotype is museum colour with darker tips to the arms. The dried paratype is generally museum colour, with some trace of pink abactinally and actinally while the arm tips are a darker museum brown. A colour transparency sent to the authors by Dr. Jangoux (1976, pers. comm.) shows the species to be uniformly light orange abactinally, with arm tips darker.

HABITS:

This species is relatively common in the Seychelles Archipelago (Jangoux, 1976, pers. comm.) where Jangoux (1974) records it frequently as host to the fish parasite, *Carapus homei*. The fish occurs within the body cavity of the starfish.

ETYMOLOGY: Named after the area where it was taken.

***Thromidia gigas* (Mortensen)**

Fig. 10

Mithrodia gigas Mortensen, 1935, p. 1, fig. 1, plate 1; Cherbonnier, 1975, p.639, pls. I-II.

MATERIAL EXAMINED:

Holotype (South African Museum No. A 22561) off Point Morgan, East London, South Africa, in a depth 45-54 m, on 28 January, 1934, collected by Mr. Bell Marley. The starfish was taken on a fish-hook, after taking the bait.

DESCRIPTION:

There is little to add to the detailed description given by Mortensen (1935). There are, however, some slight discrepancies in his measurements and in the number of furrow spines Mortensen recorded. We found $R = 330 - 347$ mm, $r = 45$ mm, $R/r = 7.3 - 7.7$, and the furrow spines number from 5 — 6 generally and sometimes up to 8 per plate. We have included a new photograph of an arm tip of the holotype (Fig 10) for direct comparison with those of *T. catalai* and *T. seychellesensis*.

Cherbonnier (1975) has recorded a specimen off the west coast of Madagascar thus extending the range of the species. His specimen is about two thirds of the size of the holotype and rather contorted. Whether the measurements given by Cherbonnier correspond to the conventional way of measuring R and r is unclear.

NEW SPECIES OF MITHRODIAE

We think that by "le diametre due disque . . ." Cherbonnier may refer, in fact, to r giving his specimen a R/r ratio of 6.6 — 7.6, and this conforms with his illustration and our diagnosis of the genus.

COLOUR:

In life the holotype was purplish-pink abactinally with the tips of the arms more cinnamon red, actinally it was pale yellowish, with the tube-feet white.

COMPARISON OF *T. CATALAI*, *T. SEYCHELLESENSIS* AND *T. GIGAS*

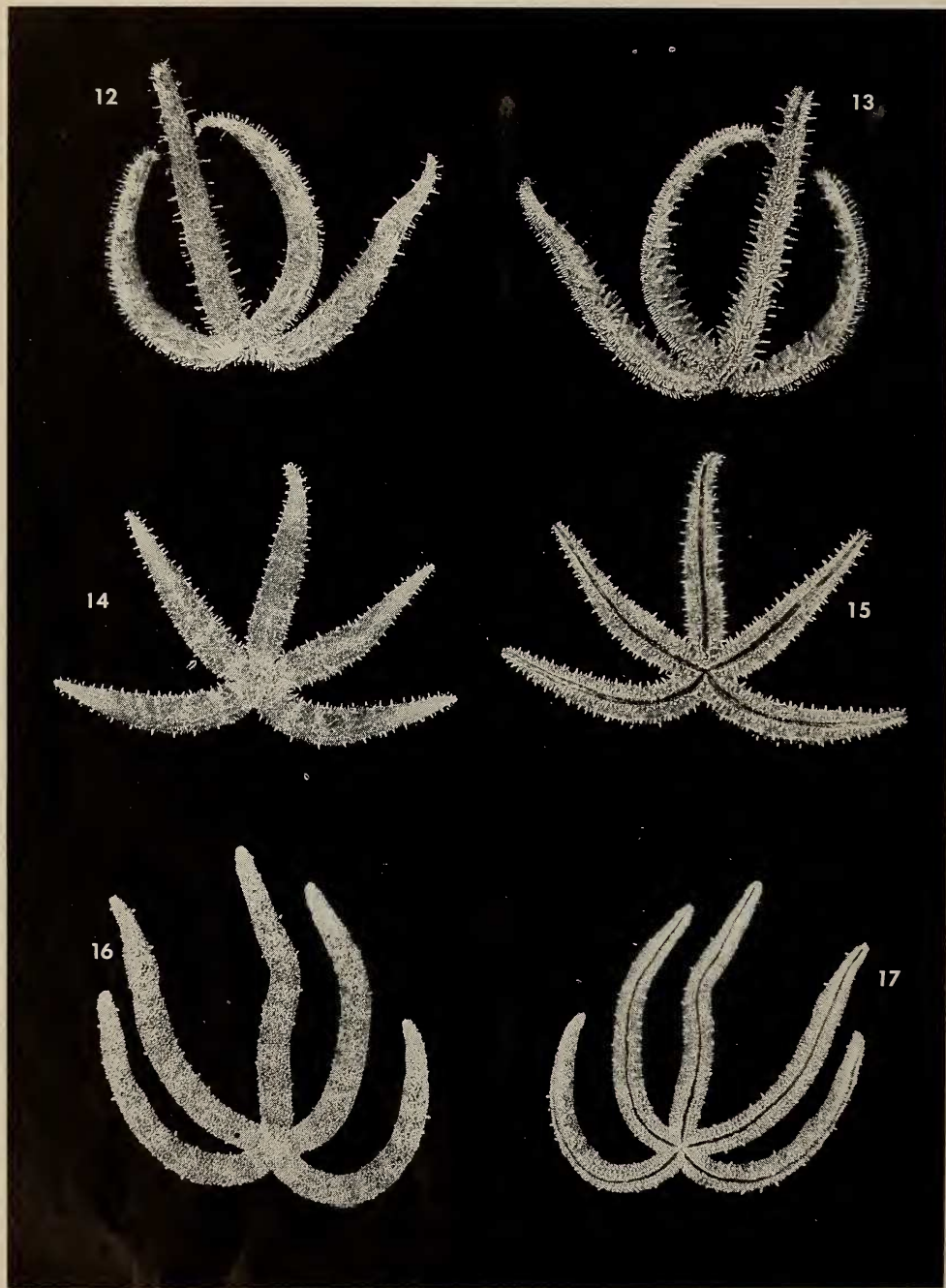
T. catalai differs markedly from *T. seychellesensis* (comparing two specimens of similar size, one from each species), in the arrangement of the skeletal reticulum, size of the papular areas and arrangement of plates and tubercles near the arm tips. Both of these new species are distinguished from *T. gigas* in their arm proportions, which are shorter and stouter than in the South African species, and in the lack of the very prominent, globular bosses on the arm tips.

KEY TO SPECIES OF *THROMIDIA*

- 1 $R/r = 6.5-7.6/1$; arm tips with large globular bosses (5 mm diameter) (Fig. 10); S.E. Africa (East London) — west coast Madagascar *T. gigas* (Mortensen)
- 1¹ $R/r < 6/1$, arm tips without large globular bosses 2
- 2 $R/r = 4.9 - 5.5/1$, arm tips with closely packed rounded, slightly convex plates, covered with even granules, giving cobbled appearance (Fig. 11); Seychelles (Western Indian Ocean) *T. seychellesensis* sp. nov.
- 2² $R/r = 4.5.2/1$, arm tip with spaced plates bearing small tubercles (Fig. 9); Pacific Ocean (Hawaii, Japan, Philippines, New Caledonia, New Guinea) *T. catalai* sp. nov.

DISCUSSION

The first two representatives of *Thromidia* were collected by the U.S. Fisheries ship "Albatross" off the Bird Islands, Hawaii in 1902. These were the juvenile specimens referred to by Fisher (1906, p. 1069) as "A peculiar specimen of the genus *Mithrodia*". They differed somewhat from other specimens of the species collected by the "Albatross" which Fisher identified as *Mithrodia bradleyi* Verrill. He did not, however, propose a new name for the peculiar specimens. We have not been able to locate the whereabouts of the larger of the two "peculiar specimens" but what we believe to be the smaller one is discussed above (p. 205).



Holly (1932) described a new *Mithrodia* from Hawaii, *M. fisheri*, from a damaged, obviously juvenile specimen. He wrongly synonymised Fisher's "peculiar specimens" with his new species and failed to appreciate that it was the specimens identified and figured by Fisher (1906) in Plate XXXVI and Plate XXXVII Fig. 1, as *M. bradleyi* that in reality represented an adult of his *M. fisheri* (see below).

Mortensen (1935), in describing *M. gigas*, compared it with *M. bradleyi* sensu Fisher (1906), non Verrill (1868) and he failed to recognise in *M. gigas* differences considered by us to be of generic significance. He listed *M. bradleyi* as a valid species, not realising that Fisher's Hawaiian record in reality referred to Holly's species which had been undescribed at the time of Fisher's report. The validity of *M. bradleyi* Verrill, from the west coast of America is dealt with below (p. 214).

Engel et al. (1948) also did not realise the significance of Fisher's "peculiar specimens" but did realise Fisher's blunder in the identification of *M. bradleyi*. They referred both *M. bradleyi* sensu Fisher and his "peculiar specimens" to the synonymy of *M. fisheri* Holly.

There are no further records of the capture of specimens of *Thromidia* until the senior author encountered the first of the very large specimens, now the holotype, of *T. catalai*, from the lagoon off Noumea, New Caledonia in 1969. All subsequent known records are set out above.

COMMENTS ON THE STATUS OF THE SPECIES OF *MITHRODIA*

In a major review of the genus *Mithrodia*, sensu lata, Engel, John and Cherbonnier (1948) listed five species as follows: *M. clavigera* (Lamarck, 1816); *M. victoriae* Bell, 1882; *M. bradleyi* Verrill, 1867; *M. fisheri* Holly, 1932 and *M. gigas* Mortensen, 1935. Of these *M. gigas* has been referred in this paper to the new genus, *Thromidia*, for the reasons stated. Of the remaining four, we believe that *M. fisheri* is clearly defined and that the relationship between *M. clavigera*, *M. bradleyi* and *M. victoriae* still needs clarification.

Holly correctly recognised a new species, *M. fisheri* for a Hawaiian form (Figs. 16-17) even though his description was based on a damaged specimen. We do not agree with him, however, in identifying Fisher's "peculiar specimens" with

Figs. 12-13. *Mithrodia clavigera* (Lamarck), A.M. No. J5845, abactinal (12) and actinal (13) views, R = 200 mm. (Great Barrier Reef [Capricorn Group]). One arm broken off.

Figs. 14-15. *M. clavigera* (Lamarck) (identified as *M. bradleyi* Verrill), Allan Hancock No. 245 — 12, abactinal (14) and actinal (15) views, R = 165 mm. (California [Mexico]).

Figs. 16-17. *M. fisheri* Holly, Allan Hancock No. 726 — 1, abactinal (16) and actinal (17) views, R = 152.5 mm (Hawaii).

his new species as we have stated above (p. 213). In fact, part of the confusion in the recognition of *M. bradleyi* has arisen from Fisher's (1906) identification of that species from Hawaii. It appears he had examined at least one of Verrill's specimens from La Paz and confused the identity of his Hawaiian specimens with what he thought to be Verrill's species. Fisher's material was clearly in a good state of preservation when examined and photographed. He probably did not directly compare his specimens against Verrill's description (1867) and (1914) of the holotype of *bradleyi* but rather with one of the poorly preserved La Paz specimens, this being inferred in a letter which he subsequently wrote to, and was quoted by, Engel et al (1948, p. 18) admitting his mistake. We therefore concur with Engel et al in recognising the validity of *fisheri* for the reasons set out by them.

The status of *M. victoriae* is doubtful. Miss A. M. Clark examined the two syntypes in the British Museum (Natural History) (No. 1879.8.19.97) and concluded that she could find no difference between them and similar sized specimens of *M. clavigera* from Macclesfield Bank, South China Sea (personal communication to senior author, 1972) and that there seemed little doubt as to the origin of the specimens from Victoria Bank, Brazil (personal communication to the junior author, 1976). The junior author examined Bell's specimens of *M. victoriae* in 1975 and was unable to draw any different conclusions from those of Miss Clark. Engel et al were certainly very doubtful of both the validity of this species and its actual origin from Brazil, together with a second similar specimen also labelled "Brazil", held in the Leiden Museum, Netherlands. The authors therefore believe that *M. victoriae* should be considered a synonym of *M. clavigera*.

That *M. clavigera* is a valid species is without doubt. However, on referring to Verrill's description of the holotype of *M. bradleyi* (1867) and his subsequent photographic illustration (1914, pl. CXII) of the type-specimen, we can see little justification for the separation of this form from *clavigera*. We have compared a specimen from Lower California (Allan Hancock Foundation Cat. No. 275.12), labelled *M. bradleyi* (Figs. 14-15) with a comparably sized specimen of *M. clavigera* from North Reef, Capricorn Group of Islands, Queensland (Australian Museum No. J5845) (Figs. 12-13) and with a whole range of specimens in the Australian Museum from localities across the Pacific and from Mauritius, Indian Ocean. Taking point for point the characters discussed by Engel et al in distinguishing *M. bradleyi*, considering the wide variation in the characters of *M. clavigera* admitted by those authors, we find it difficult to detect any character which would justify the recognition of a specific distinction between eastern and western Pacific forms. The only two features of distinction appear to be the stouter arms and shorter spines of *bradleyi*, both features being present also in a large specimen (R = 225 mm, r = 32 mm; A.M. No. J9927) collected from New Caledonia. If these features are considered of specific importance then *M. bradleyi* and *M. clavigera* are sympatric (at least in the central Pacific area). It is unfortunate that the type specimens of *M. clavigera* and *bradleyi* cannot be directly compared

and that the two specimens from La Paz identified by Verrill as *bradleyi* are in such a poor state of preservation. Interestingly, Perrier (1875, p. 117) in a footnote commented that *M. bradleyi* was "peut-être identique elle aussi à l'espèce de l'Île de France (*M. clavigera*)", though Engel et al did not agree. We conclude that until a greater amount of comparative material has been examined (Engel et al compared only 4 specimens including at least 2 poorly preserved specimens of *bradleyi* against 47 specimens of *clavigera*), firm conclusions on the relationship between these two species are difficult to draw, but we feel that *bradleyi* is little more than an eastern Pacific form of the widely distributed and variable *M. clavigera*.

DISTRIBUTION

The distribution of the genus *Mithrodia*, like that of *Thromidia*, is Indo-Pacific. The Atlantic records for *Mithrodia victoriae* (synonym of *M. clavigera*) may be doubtful (Engel et al. 1948). *Mithrodia clavigera*, omitting the above doubtful record, is therefore distributed from Mauritius and the Red Sea through the Pacific to Lower California and Panama. *Mithrodia fisheri* occurs around Hawaii. It is also reported from Arica, Peru by H. L. Clark (1910) under the name of *M. bradleyi* (sensu Fisher) and while it is obvious from his figured specimen that he was dealing with *M. fisheri* his suspicions concerning its locality of origin might be well founded and should be taken into account. Engel and his co-authors (1948) report a specimen of *fisheri* from New Ireland, Bismarck Archipelago (originally identified as *M. clavigera* by Sluiter 1895) and one from the Philippine Islands. We have not examined these specimens.

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